A Clinical and Nutritional Comparison of Biliopancreatic Diversion With and Without Duodenal Switch

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Objective: To compare biliopancreatic diversion (BPD) without duodenal switch (DS) and with duodenal switch (BPDDS).

Background: A reduction of 70% of excess body weight can be achieved after BPD, but there is a risk of malnutrition and diarrhea. This risk may be reduced by pyloric preservation with BPDDS.

Methods: BPD was performed until 1999, when BPDDS was introduced, both with a common channel of 50 cm. At their latest clinic visit, patients filled in a questionnaire regarding weight loss, dietary history, gastrointestinal symptoms, obesity-related comorbidity, and medication including dietary supplements and underwent a serum nutritional screen.

Results: BPD was performed in 73 patients and BPDDS in 61 patients, with a median preoperative body mass index (BMI) of 44.8 kg/m^2 and a median follow-up of 28 months. There were no significant differences between BPD and BPDDS with regards to age, sex, BMI, or morbidity. Median excess weight loss and BMI at 12, 24, and 36 months was 64.1, 71.0, and 72.1% and 33.1, 31.5, and 31.5 kg/m^2, respectively; there were no significant differences between BPD and BPDDS. There were no significant differences between BPD and BPDDS with regards to meal size, fat score, nausea, vomiting, diarrhea, or nutritional parameters. However, 18% of patients were hypoalbuminemic, 32% anemic, 25% hypocalcemic, and almost half had low vitamin A, D, and K levels, despite more than 80% taking vitamin supplementation.

Conclusion: DS does not improve weight loss or lessen the gastrointestinal or nutritional side effects of BPD.

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Biliopancreatic diversion (BPD) as described by Scopinaro has been performed for morbid obesity for over 25 years[1] and results in effective and sustained long-term weight loss.[2] However up to 10% of patients will suffer protein malnutrition,[3] and vitamin deficiencies have also been described.[4] It has been suggested that preservation of the pylorus in BPD with duodenal switch (BPDDS) may help to prevent protein malnutrition by "preserving normal gastric function as the initiator of protein digestion."[5] To our knowledge, BPD and BPDDS using identical length common channels has not yet been compared.

MATERIALS AND METHODS

BPD as described by Scopinaro in 1976[1] was our malabsorptive procedure of choice until December 1999 when BPDDS[6] was introduced. Both procedures were performed with a common channel of 50 cm. Once experience had been gained at open surgery, both procedures were performed laparoscopically, BPD from 1998 onwards and BPDDS from 2000 onwards. However, laparoscopic procedures were not attempted during this time if the patient had previous open vertical banded gastroplasty (VBG). Identical operations were performed at both open and laparoscopic surgery.

At their most recent clinic visit, patients were asked to fill in a questionnaire regarding weight loss, dietary history, gastrointestinal symptoms, obesity-related comorbidity, and medication including dietary supplements. A separate questionnaire was used to estimate the amount of fat in their diet by producing a fat score; the higher the fat score, the greater the amount of fat in their diet.[7] Dietary history included questions regarding the size of their meals compared with before surgery, with a score of 1 for less than one quarter of a full-sized meal to a score of 5 for a full-sized meal, and questions regarding nausea, vomiting, and diarrhea after surgery, with a score of 0 for no symptoms, 1 for monthly, 2 for weekly, and 3 for daily symptoms.

At their most recent clinic visit, patients were given a request form for serum hemoglobin, iron, glycosylated hemoglobin, urea, and electrolytes, liver function tests including alkaline phosphatase and albumin, calcium, parathyroid hormone, zinc, selenium, magnesium, and vitamins A, D, E, and K.

RESULTS

BPD was performed in 73 patients and BPDDS in 61 patients; 70 of these cases were the first bariatric procedure,

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TABLE 1. Weight Loss in 134 Patients After Biliopancreatic Diversion Without (BPD) and With Duodenal Switch (BPDDS) as an Open or Laparoscopic Procedure

	Open BPD	Lap BPD	Open BPDDS	Lap BPDDS	*P* value
Number of cases	59 (44.0%)	14 (10.4%)	31 (23.1%)	30 (22.4%)	
Primary procedure	31 (52.5%)	11 (78.6%)	9 (29.0%)	19 (63.3%)	0.18
Age (years)	44 (33–68)	41 (28–57)	47 (32–63)	41 (23–67)	0.34
Females	47 (79.7%)	12 (85.7%)	22 (71.0%)	20 (66.7%)	0.11
Operative time (min)	134 (83–290)	169 (140–239)	138 (87–232)	181 (92–315)	0.53
Complications	24 (40.7%)	4 (28.3%)	11 (35.6%)	7 (23.3%)	0.28
Hospital stay (days)	8.5 (4–72)	6 (5–16)	8 (5–168)	7 (4–146)	0.42
Follow-up (months)	38 (6–50)	34 (22–37)	23 (7–37)	21 (1–30)	0.001
Channel shortening	6 (10.3%)	1 (7.1%)	5 (6.1%)	3 (10.0%)	0.38
Channel lengthening	3 (5.1%)	1 (7.1%)	1 (3.2%)	2 (6.7%)	0.71
BMI preoperative	45.2 (25.5–83.7)	44.8 (30.1–62.7)	43.9 (26.1–60.5)	45.5 (29.9–66.9)	0.38
BMI 3 months (kg/m^2)	39.0 (24.0–60.5)	38.9 (27.4–57.4)	36.7 (24.9–54.3)	39.5 (27.2–57.8)	0.19
BMI 6 months	36.4(22.6–59.0)	36.4 (23.8–52.7)	32.5 (24.9–54.3)	34.4 (24.6–51.5)	0.31
BMI 12 months	34.0 (20.7–54.8)	31.3 (19.9–48.9)	31.3 (22.5–47.1)	31.9 (17.3–46.6)	0.14
BMI 24 months	30.6 (18.1–52.6)	31.1 (20.9–38.5)	29.4 (24.3–42.5)	31.0 (17.3–45.5)	0.41
BMI 36 months	29.7 (16.7–52.6)	30.9 (22.1–38.5)	27.4 (23.9–36.9)	32.0 (30.4–39.5)	0.59
%EWL 3 months	27.8 (0–153.8)	24.5 (0–72)	35.9 (11.4–193.5)	30.0 (13.0–71.8)	0.07
%EWL 6 months	43.7 (0–129.0)	37.6 (0–109.6)	58.2 (13.1–258.0)	48.5 (19.6–105.3)	0.06
%EWL 12 months	55.1 (0–185.0)	54.1 (8.5–125.8)	67.7 (11.4–258.1)	58.5 (23.2–201.0)	0.25
%EWL 24 months	64.4 (0–240.0)	65.1 (22.6–120.3)	77.7 (11.2–258.6)	68.1 (13.8–201.0)	0.40
%EWL 36 months	68.5 (0–342)	69.0 (34.2–120.3)	91.8 (61.7–193.5)	65.9 (26.6–78.5)	0.29

BMI, body mass index; %EWL, excess weight loss expressed as a percentage. Each value is a median with the range in parentheses. *P* value is the result of a Mann-Whitney *U* or χ^2 test as appropriate between BPD and BPDDS.

and 64 were secondary procedures after failed laparoscopic adjustable gastric banding (LAGB) in 50 patients and failed VBG in 14 patients. Failed LAGB included patients who had lost weight but who could not tolerate the dietary restrictions of the band or had a complication that necessitated removal of the band, the most common being recurrent slippage.

One hundred one (75.4%) patients were female, and median age was 44 (range, 23 to 68) years. Median preoperative weight was 126.0 kg (62.9 to 242.1 kg) and BMI was 44.8 kg/m^2 (25.5 to 83.7 kg/m^2). Patients have been followed up for a median of 28 months (6 to 50 months) after surgery. Laparoscopic procedures were performed late in the series, with 14 of 73 BPD and 30 of 61 BPDDS performed laparoscopically.

There was a single in-hospital mortality (0.7%), a 65-year-old man who died 21 days after laparoscopic BPDDS as a result of necrotizing pancreatitis. To date, 3 other patients have died on follow-up, 2 myocardial infarcts 7 and 9 months after surgery, and a pulmonary embolism more than 2 years after surgery.

Forty-six patients suffered complications, the most common being wound infection in 16 patients (11.9%) and dehiscence in 14 patients (10.4%), 12 of which were superficial. Seven (5.2%) had an anastomotic leak, which necessitated a laparotomy in 4 patients; in 3 patients, a radiologic leak was treated conservatively with intravenous antibiotics. A single patient had a further leak from the gastrojejunostomy and developed a gastrocutaneous fistula, which failed to heal and eventually underwent total gastrectomy. Postoperative bowel obstruction was documented in 3 patients, all of which resolved with conservative treatment, and a further 2 patients had bleeding from a staple line which required under-running. There was a single deep vein thrombosis and a case of postoperative pneumonia. Complications were commoner with open procedures (Table 1), although this failed to reach statistical significance ($P = 0.11$, χ^2).

As expected, weight loss after open and laparoscopic BPD was similar ($P = 0.99$, Mann-Whitney *U*), as it was between open and laparoscopic BPDDS ($P = 0.33$, Mann-Whitney *U*) (Table 1). Operative time was longer with laparoscopic (median, 170; range, 92 to 315 minutes) than open (median, 134; range, 88 to 290 minutes) surgery ($P = 0.02$, Mann-Whitney *U*), and hospital stay was shorter with laparoscopic surgery ($P = 0.003$, Mann-Whitney *U*).

There were no significant differences between BPD and BPDDS with regards to age ($P = 0.38$, Mann-Whitney *U*), sex

TABLE 2. Resolution of Obesity-Related Comorbidity After Biliopancretic Diversion Without (BPD) and With Duodenal Switch (BPDDS)

	BPD	BPDDS	*P* value
Diabetes Mellitus	8 (11.0%)	11 (18.0%)	0.26
Resolution	7 (87.5%)	9 (81.8%)	0.23
Hypertension	22 (30.1%)	7 (11.5%)	0.22
Resolution	15 (68.2%)	5 (71.4%)	0.82
Sleep apnoea	9 (12.3%)	12 (19.7%)	0.87
Resolution	6 (66.7%)	11 (91.7%)	0.34

P value is the result of a chi-squared test between BPD and BPDDS.

($P = 0.11$, χ^2), preoperative BMI ($P = 0.38$, Mann-Whitney *U*), or morbidity ($P = 0.28$, χ^2) (Table 1). Not surprisingly, follow-up was longer after BPD (39 months) than BPDDS (24 months) ($P = 0.001$, Mann-Whitney *U*). Overall the median %EWL and BMI at 12 (128 or 96% of patients), 24 (109 or 81% of patients), and 36 (52 or 39% of patients) months was 64.1, 71.0, and 72.1% and 33.1, 31.5, and 31.5 kg/m^2, respectively; there were no significant differences in weight loss between BPD and BPDDS at 3, 6, 12, 24, or 36 months after surgery (all $P > 0.07$, Mann-Whitney *U*).

Seven patients (9.6%) required shortening of the common channel to 40 cm due to insufficient weight loss after BPD compared with 8 patients (13.1%) after BPDDS ($P = 0.38$, χ^2). After BPD, 4 patients (5.5%) required lengthening of their common channel due to excessive weight loss compared with 3 patients (4.9%) after BPDDS ($P = 0.42$, χ^2).

With regards to obesity-related comorbidity, 16 of 18 (88.9%) patients with diabetes and 20 of 29 (69.0%) hypertensive patients stopped medication postoperatively. Seventeen of 21 patients (81.0%) with obstructive sleep apnea had no symptoms after surgery. There were no significant differences between BPD and BPDDS in treating obesity-related comorbidity (all $P > 0.22$, χ^2) (Table 2).

A total of 103 patients returned their questionnaires, 56 (76.7%) after BPD and 47 (77.0%) after BPDDS (Table 3). Thirty-eight (52.1%) of these patients had diarrhea after BPD compared with 37 (60.7%) after BPDDS ($P = 0.22$, χ^2). There were no significant differences between BPD and BPDDS with regards to meal size, fat score, nausea, vomiting, or diarrhea (Table 3). Forty-five of 56 patients (80.4%) used regular multivitamin supplementation after BPD and 39 of 47 (83.0%) patients after BPDDS ($P = 0.73$, χ^2).

Eighty-three patients (61.9%) had a complete nutritional screen at their last clinic visit. Patients have to pay for these tests in Australia, and the vitamin analyses in particular are expensive. The blood results are from a median of 37 months after BPD and 23 months after BPDDS. Fifteen patients (18.1%) were hypoalbuminemic, 27 (32.5%) were anemic, and 19 (22.9%) had a low serum iron after surgery (Table 4). Zinc, selenium, and magnesium were low in 9 (10.8%), 12 (14.5%), and 4 (4.8%) patients, respectively. Calcium was low in 21 (25.3%), alkaline phosphatase high in 19 (22.9%), and parathyroid hormone high in 43 (51.8%) patients. Vitamins A, D, E, and K were low in 51 (61.4%), 41 (49.4%), 4 (4.8%), and 42 (50.6%) patients. There were no significant differences between BPD and BPDDS in any of these measured serum levels (Table 4).

A significantly greater number of female patients underwent BPD or BPDDS as a secondary bariatric procedure after failure of a previous bariatric procedure ($P = 0.002$, χ^2) (Table 5). Not surprisingly, laparoscopic surgery was more common in the primary bariatric procedure group ($P = 0.01$, χ^2) (Table 5). There were no significant differences in morbidity, operative time, hospital stay, or weight loss between

TABLE 3. Gastrointestinal Symptoms, Dietary History, and the Use of Multivitamins After Open and Laparoscopic Biliopancreatic Diversion Without (BPD) and With Duodenal Switch (BPDDS) in 103 Patients With Completed Questionnaires

	Open BPD	Lap BPD	Open BPDDS	Lap BPDDS	*P* value
Number of cases	45 (76.2%)	11 (78.5%)	23 (74.2%)	24 (80.0%)	
Diarrhoea	30 (68.9%)	7 (73.6%)	16 (69.6%)	21 (87.5%)	0.22
Median score	3 (0–3)	1 (0–3)	2 (0–3)	2 (0–3)	
Nausea	10 (24.4%)	1 (9.1%)	8 (34.8%)	4 (16.7%)	0.62
Median score	0 (0–3)	0 (0–2)	0 (0–3)	0 (0–3)	
Vomiting	11 (24.4%)	0	5 (21.7%)	4 (16.7%)	0.95
Median score	0 (0–3)	0	0 (0–2)	0 (0–3)	
Meal size	2 (1–5)	3 (1–5)	3 (1–5)	3 (1–5)	0.38
Fat score	3.3 (1.5–5.6)	3.0 (2.3–4.8)	3.3 (2.4–4.5)	3.2 (2.0–5.4)	0.93
Multivitamins	34 (75.6%)	11 (100%)	18 (78.3%)	21 (87.5%)	0.73

P value is the result of a Mann-Whitney U or χ^2 test as appropriate between BPD and BPDDS.

TABLE 4. Nutritional Screen 37 Months After BPD and 23 Months After BPDDS

	Open BPD	Lap BPD	Open BPDDS	Lap BPDDS	*P*
Number of cases	38	9	17	19	
Hemoglobin	123 (96–154)	119 (82–149)	122 (102–149)	129 (102–)	0.35
Low (<115 g/L)	15 (39.5%)	1 (11.1%)	4 (23.5%)	7 (36.8%)	
Iron	13 (4–22)	14 (5–21)	10 (5–21)	13 (2–21)	0.26
Low (<10 μmol/L)	5 (13.2%)	1 (11.1%)	8 (47.1%)	5 (26.3%)	
Glycosylated hemoglobin	4.5 (3.1–8.0)	4.6 (3.6–5.8)	5.1 (4.2–7.0)	4.4 (3.9–5.5)	0.11
High (>6%)	2 (5.3%)	0	1 (5.9%)	0	
Albumin	39 (20–46)	33 (26–42)	39 (34–45)	40 (26–43)	0.28
Low (<35 g/L)	5 (13.2%)	3 (33.3%)	1 (5.9%)	6 (31.6%)	
Alkaline phosphatase	88 (53–154)	89 (68–181)	111 (70–227)	107 (56–164)	0.12
High (>115 U/L)	5 (13.2%)	2 (22.2%)	8 (47.1%)	4 (21.1%)	
Calcium	2.3 (2.1–2.7)	2.4 (2.2–2.8)	2.3 (2.2–2.4)	2.3 (2.1–2.6)	0.53
Low (<2.25 nmol/L)	13 (34.2%)	1 (11.1%)	3 (17.6%)	4 (21.1%)	
Parathyroid hormone	49 (29–78)	47 (28–62)	56 (19–95)	41 (20–77)	0.73
High (>40 ng/L)	20 (52.6%)	4 (44.4%)	12 (70.6%)	7 (36.8%)	
Zinc	12 (5–19)	12 (6–19)	12 (9–16)	12 (9–19)	0.26
Low (<10 μmol/L)	4 (10.5%)	3 (33.3%)	0	2 (10.5%)	
Selenium	0.9 (0.3–1.3)	0.8 (0.3–1.4)	1.0 (0.6–1.4)	1.0 (0.4–1.4)	0.06
Low (<0.7 μmol/L)	5 (13.2%)	3 (33.3%)	2 (11.8%)	2 (10.5%)	
Magnesium	0.8 (0.7–1.8)	0.7 (0.6–0.9)	0.8 (0.7–0.9)	0.8 (0.7–1.1)	0.08
Low (<0.7 mmol/L)	2 (5.3%)	2 (22.2%)	0	0	
Vitamin A	1.4 (0.3–2.4)	1.2 (0.4–2.0)	1.4 (0.6–3.0)	1.4 (0.3–1.2)	0.12
Low (<1.6 μmol/L)	24 (63.2%)	6 (66.7%)	11 (64.7%)	10 (52.6%)	
Vitamin D	44 (14–120)	70 (30–107)	30 (15–100)	43 (15–170)	0.24
Low (<50 nmol/L)	19 (50.0%)	2 (22.2%)	12 (70.6%)	8 (42.1%)	
Vitamin E	14 (4–32)	20 (11–22)	14 (6–27)	15 (8–25)	0.60
Low (<7 μmol/L)	2 (5.3%)	0	1 (5.9%)	1 (5.3%)	
Vitamin K	0.3 (0.1–2.6)	0.2 (0.1–0.5)	0.2 (0.1–0.5)	0.2 (0.1–0.7)	0.28
Low (<0.3 nmol/L)	17 (44.7%)	5 (55.6%)	10 (58.8%)	10 (52.6%)	

Each value is either a median with the range in parentheses or the number of cases with percentage in parentheses. *P* value is the result of a Mann-Whitney *U* test between BPD and BPDDS.

BPD or BPDDS as primary or secondary procedures (Table 5), nor were there any differences in gastrointestinal symptoms, meal size, fat score, or use of multivitamins (Table 6).

DISCUSSION

BPD with or without DS results in a weight loss of 70% of excess weight, and this is in keeping with other studies of BPD[2] and BPDDS[8,9] and is greater than that documented for VBG.[10] This weight loss is sustained for greater than 10 years.[2] Similar weight loss has been described over a shorter term with LAGB[11] and Roux-en-Y gastric bypass (RYGB).[12] The rate of resolution of diabetes mellitus by BPD and BPDDS is similar to that with RYGB,[13] with similar rates of resolution for hypertension and obstructive sleep apnea. Our study adds to previous reports that BPD[14] and BPDDS[15,16] can be performed laparoscopically without compromising results or safety. To our knowledge, this is the first study to demonstrate that laparoscopic BPD and BPDDS can be performed as a revisionary procedure after failed restrictive bariatric surgery. Laparoscopic BPD and BPDDS resulted in a shorter hospital stay and fewer complications, mainly due to a lower rate of wound infection and dehiscence. Overall, 1 in 4 of the patients suffered a complication, the majority being wound infection and superficial dehiscence. One in 10 patients will require lengthening of the common channel, and 1 in 20 will require shortening of the channel, a reoperation rate similar to that after LAGB[17] and RYGB.[18]

BPD and BPDDS were remarkably similar in terms of weight loss, complications, resolution of comorbidities, gastrointestinal symptoms, and nutritional factors. This contradicts a previous study suggesting that BPDDS results in less unpleasant gastrointestinal symptoms and nutritional defi-

TABLE 5. Weight Loss in 134 Patients After BPD and BPDDS as a Primary or Secondary Procedure

	Primary BPD	Primary BPDDS	Secondary BPD	Secondary BPDDS	*P*
Number of cases	42 (57.5%)	28 (45.9%)	31 (42.5%)	33 (54.1%)	
Laparoscopic procedure	11 (26.2%)	19 (67.9%)	3 (9.7%)	11 (33.3%)	0.01
Age (years)	45 (28–68)	42 (23–67)	44 (28–61)	47 (25–65)	0.72
Females patients	31 (73.8%)	14 (50.0%)	28 (90.3%)	28 (84.8%)	0.002
Operative time (min)	152 (90–259)	195 (104–315)	148 (83–290)	142 (87–232)	0.40
Complications	19 (45.2%)	9 (32.1%)	9 (29.0%)	9 (27.3%)	0.15
Hospital stay (days)	8 (5–31)	8 (4–168)	9 (4–72)	7 (4–52)	0.46
Follow up (months)	36 (6–49)	21 (7–35)	36 (6–50)	23 (1–39)	0.22
Channel shortening	2 (4.8%)	4 (14.3%)	4 (12.9%)	4 (12.1%)	0.58
Channel lengthening	2 (4.8%)	1 (3.6%)	2 (6.5%)	2 (6.1%)	0.47
BMI preoperative	45.4 (32.6–83.7)	46.1 (33.8–66.9)	41.4 (25.5–72.0)	42.7 (26.1–58.1)	0.001
BMI 3 months (kg/m^2)	40.4 (28.1–57.4)	39.2 (28.6–57.8)	36.0 (24.0–60.5)	33.4 (24.0–47.6)	0.003
BMI 6 months	36.8 (23.8–55.0)	35.4 (24.8–54.3)	32.7 (22.6–59.0)	31.2 (24.6–47.1)	0.03
BMI 12 months	34.2 (19.9–50.9)	34.1 (20.9–46.6)	31.3 (20.7–54.8)	30.3 (17.3–47.1)	0.14
BMI 24 months	30.0 (20.9–48.1)	31.0 (23.1–45.5)	33.0 (18.1–52.6)	29.8 (17.3–47.6)	0.82
BMI 36 months	29.4 (21.5–50.2)	33.6 (30.4–36.9)	32.7 (16.7–52.6)	27.4 (24.0–39.5)	0.55
%EWL 3 months	25.8 (0–74.4)	32.6 (13.0–67.6)	27.8 (0–153.8)	34.0 (11.4–193.5)	0.34
%EWL 6 months	45.7 (0–109.6)	53.1 (29.7–101.4)	40.0 (0–129.0)	52.3 (13.1–258.1)	0.48
%EWL 12 months	57.8 (8.5–125.8)	60.8 (20.2–141.3)	50.9 (0–185.0)	64.0 (0–258.1)	0.46
%EWL 24 months	70.1 (22.6–120.3)	72.0 (40.6–111.5)	59.3 (0–240.0)	71.6 (11.4–193.5)	0.07
%EWL 36 months	78.4 (27.0–120.3)	70.1 (61.7–78.5)	56.6 (0–342.0)	87.6 (26.6–193.5)	0.16

BMI, body mass index; %EWL, excess weight loss expressed as a percentage. Each value is a median with the range in parentheses. *P* value is the result of a Mann-Whitney *U* or χ^2 test as appropriate between primary and secondary bariatric procedures.

ciencies than BPD.[16] However, this previous study compared BPDDS with a 100-cm common channel to BPD with a 50-cm common channel; in view of the findings of our study, it is likely that it is the 100-cm common channel rather than the duodenal switch that has resulted in fewer side effects. If the common channels are the same length, then there is no benefit in adding a duodenal switch to BPD. The results of BPD and BPDDS were similar when performed as a primary procedure or as a secondary procedure after failed previous bariatric surgery.

TABLE 6. Gastrointestinal Symptoms, Dietary History, and the Use of Multivitamins After Primary and Secondary BPD and BPDDS in 103 Patients With Completed Questionnaires

	Primary BPD	Primary BPDDS	Secondary BPD	Secondary BPDDS	*P*
Number of cases	30 (71.4%)	20 (71.4%)	26 (83.9%)	27 (81.8%)	
Diarrhea	19 (63.3%)	18 (90.0%)	19 (73.1%)	19 (70.4%)	0.79
Median score	2 (0–3)	2 (0–3)	2 (0–3)	2 (0–3)	
Nausea	5 (16.7%)	5 (25.5%)	7 (26.9%)	7 (25.9%)	0.44
Median score	0 (0–3)	0 (0–3)	0 (0–3)	0 (0–3)	
Vomiting	7 (23.4%)	3 (15.0%)	4 (12.9%)	6 (22.2%)	0.89
Median score	0 (0–3)	0 (0–3)	0 (0–2)	0 (0–2)	
Meal size	4 (1–5)	4 (1–5)	5 (2–5)	4 (1–5)	0.21
Fat score	3.3 (1.5–5.6)	3.1 (2.2–4.5)	3.3 (2.2–4.5)	3.6 (2.0–5.4)	0.21
Multivitamins	24 (80.0%)	17 (85.0%)	21 (83.9%)	22 (81.5%)	0.91

P value is the result of a Mann-Whitney *U* or χ^2 test as appropriate between primary and secondary bariatric procedures.

A worrying discovery in our study was that almost 1 in 5 patients were not taking dietary supplementation, despite the fact that half of the patients were vitamin A and D deficient. These deficiencies are not commonly reported after BPD or BPDDS, although bone loss has been described in 15% of patients.[5] The frequency of hypoalbuminemia in this study was similar to that reported after BPD[2] and BPDDS.[5] Anemia was more common in this study using a 50-cm common channel compared with studies of both BPD[19] and BPDDS[5] using 100-cm common channels. The need for nutritional surveillance and dietary supplementation after BPD and BPDDS cannot be overemphasized.

In conclusion, duodenal switch does not improve weight loss or lessen the nutritional side effects of BPD. Laparoscopic BPD results in fewer complications and a shorter hospital stay, and it can be performed as a primary procedure or as a revisionary procedure after failed restrictive bariatric surgery.

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